Submitted to:
US EPA Region 8
Denver, CO

Submitted by:
Atlantic Richfield Company
La Palma, CA
March 20, 2012

1225517

Blaine Base Flow Measurement Work Plan

Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01 Rico, Colorado

Atlantic Richfield Company

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March 20, 2012

VIA EMAIL AND HAND DELIVERY

Mr. Steven Way
On-Scene Coordinator
Emergency Response Program (8EPR-SA)
U.S. EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

RE: Blaine Base Flow Measurement Work Plan, Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, Rico, Colorado
EPA Unilateral Administrative Order, Docket No. CERCLA-08-2011-0005

Dear Mr. Way:

A digital file in pdf format of the Blaine Base Flow Measurement Work Plan, Rico-Argentine Mine Site – Rico Tunnels Operable Unit OU01, Rico, Colorado dated March 20, 2012 is being submitted to you today via email. Three (3) hard copies of the report will be hand-delivered to your office no later than Wednesday, March 21.

Atlantic Richfield Company (AR) is submitting this report responsive to requirements in Task E – Source Water Investigations and Controls / Subtask E2 – Additional Investigations of the Remedial Action Work Plan accompanying the Unilateral Administrative Order for Removal Action, Rico-Argentine Site, Dolores County, Colorado, U.S. EPA Region 8, Docket No. CERCLA-08-2011-0005.

If you have any questions or comments, please feel free to contact me at (714) 228-6770 or via e-mail at Anthony.Brown@bp.com.

Sincerely,

Anthony R. Brown

Tony Brown
Project Manager
Atlantic Richfield Company

Enclosure (Blaine Base Flow Measurement Work Plan)

cc: Ronald Halsey, Atlantic Richfield Company
Terry Moore, Atlantic Richfield Company
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Table of Contents

TABLES

FIGURES

1.0 Introduction

AECOM Technical Services, Inc. (AECOM), in cooperation with Anderson Engineering Co. Inc. (AECI) and on behalf of Atlantic Richfield Company (AR), has prepared this Work Plan to evaluate quantity and characteristics of flow currently being diverted within the Blaine Tunnel of the Rico-Argentine Mine Site - Rico Tunnels Operable Unit (OU01). Figure 1 illustrates the location of the tunnel relative to the Town of Rico, Colorado and the St. Louis Ponds to which it is hydraulically connected via the Southeast Crosscut and St. Louis Tunnel. Historically, the Blaine Tunnel provided drainage for the Blaine Mine and interconnected mine workings above the Blaine level, and is believed to have discharged directly to Silver Creek. At present a cofferdam approximately 350 feet inside the tunnel diverts the discharge to an incline within the mine known as the Morris-Cook and through interior workings to eventually emerge at the St. Louis Tunnel portal area.

1.1 Scope

The work will begin with a characterization of the current tunnel accessibility (**3.1 Blaine Tunnel Access Assessment**), which was problematic in early 2011, due to icing within the tunnel. Ice, if present, will be removed (**3.2 Ice Removal (if required**) to provide access. The Blaine Tunnel will then be surveyed in three dimensions to the limits of safe access to provide a baseline survey of the tunnel (**3.3 Blaine Tunnel Survey**). Next, the flow in the tunnel will be intercepted, sampled and measured to quantify the existing diverted flow and to compare loading of key parameters at the Blaine Tunnel with St. Louis Tunnel effluent loading (**3.4 Blaine Base Flow Test**). The data collected during the base flow test will be compiled, reduced and analyzed (**4.0 Data Reduction and Evaluation**). The timing and sequence of these activities is also presented in this Work Plan (**5.0 Schedule**).

1.2 Responsibilities

The base flow measurement at the Blaine tunnel will be completed mostly underground with support equipment and facilities at the surface near the mine portal. The base flow measurement activities will be distributed between the Colorado Department of Reclamation and Mine Safety (CDRMS) in conjunction with the Environmental Protection Agency (EPA) and Atlantic Richfield Company (AR) providing equipment and out-of mine support. The underground work will be accomplished by the CDRMS and its contractor(s): ice removal (if/as needed); setting up the pumping location; placement of pumping equipment and hoses; pump operation; and pump monitoring. AR will provide the equipment logistics and activities support. AR will also provide on-site technical support to direct water sampling and flow measurements.

2.0 Objectives

The overall goal of the study is to provide initial information to assess the feasibility of contaminant source control at the Blaine Tunnel to reduce or eliminate loading at the St. Louis Tunnel. The effort is designed to provide data on tunnel stability, dimensions and elevations as well as total flow and samples for water quality and preliminary treatment testing to characterize the flow within the Blaine Tunnel. These data will supplement information and data previously collected by EPA during two prior tunnel entries in 2011. This study is part of a larger effort to be conducted later in 2012 to more directly assess the impacts of flow interception at the Blaine Tunnel on flow and loading at the portal of the St. Louis Tunnel, and to provide an assessment of the feasibility of ion exchange (IX) as a contaminant reduction and resource recovery treatment technology. Specifically, the objectives of this study are to:

- Assess the performance of an air curtain constructed in November 2011 to reduce interior icing.
- Assess and record interior conditions of the Blaine tunnel.
- Provide a three-dimensional baseline survey of the Blaine tunnel.
- Intercept, sample and measure the quantity of flow currently diverted to the Morris-Cook Incline within the Blaine Tunnel in order to:
    - Provide a basis for final planning of the flow interception and treatability test at the Blaine Tunnel to be conducted later during the summer of 2012;
    - Measure metals concentration in the Blaine Tunnel drainage water, and assess load reduction of the potentially intercepted Blaine flow as compared to the flow and metals load emerging from the St. Louis Tunnel; and
    - Develop bench top data for subsequent 2012 Ion Exchange (IX) pilot scale treatability testing of the Blaine Tunnel flow, including quantity and collection of a sample to conduct initial bench-scale tests.

3.0 Investigations

The study area is illustrated on Figure 2, which shows a plan view of the Blaine Tunnel, and the staging area near the Blaine Tunnel portal. The existing interior cofferdam flow diversion to the Morris-Cook incline is approximately 350 feet back from the portal of the Blaine Tunnel. The cofferdam impounds water in a pool that is approximately 25 inches deep immediately behind the dam. The pool gradually shallows beyond the cofferdam with tunnel grade; however, available measurements indicate that the grade of the tunnel floor is not uniform such that locally slightly deeper or shallower pooled water is present than would otherwise be the case with a uniformly sloping grade. The impounded water, which is fed by interior drainage within the mine and overlying interconnected workings from other mines in Dolores Mountain, is currently seeping into the Humboldt Drift and continues to the Morris-Cook Incline (Figure 3A) where it is believed to eventually find its way down to and then through the Southeast Crosscut and thereby to the St. Louis Tunnel. Tracer tests conducted by EPA in 2011 confirmed that this water eventually emerges at the St. Louis Tunnel. Access to the Humboldt Drift from the Blaine Tunnel is currently blocked by one major roof collapse and locally impeded by two lesser roof falls upgradient of its intersection with the Morris-Cook Incline. Water impounded by the cofferdam seeps through the blockage, potentially aided by pipes that penetrate into the blockage, and eventually finds its way to the incline. The study area extends beyond the cofferdam to the limits of safe access, which in 2011 was approximately as shown on Figure 2.

The primary purpose of the Blaine Base Flow Interception Test is to provide a better estimate of the tunnel drainage upstream of the Humboldt Drift at the time of flow measurement. Although interior Blaine flows are expected to exhibit significant seasonal and possibly diurnal variation (similar to those documented at the St. Louis Tunnel), this single-point measurement will provide a basis for a preliminary estimate of potential flow contribution from the Blaine-Argentine workings to the flows measured concurrently at the St. Louis Tunnel. Coupled with water quality data, a proportional loading assessment of the Blaine-Argentine source to St. Louis Tunnel effluent will be conducted.

3.1 Blaine Tunnel Access Assessment

Initial entry to the Blaine Tunnel will investigate the condition and performance of the air curtain constructed in 2011 by CDRMS. The purpose of the air curtain was to mitigate the formation of ice within the mine over the winter, which significantly delayed access to the mine last year. Qualified personnel will enter the mine, visually assess, and document with photographs and video recordings the interior condition of the tunnel to the limits of safe access. If ice is present, measurements will be made of the location and thickness of the ice present by visual estimate. This access assessment will provide information with regard to work necessary to provide safe access to the tunnel interior for the subsequent tasks.

3.2 Ice Removal (if required)

Following the findings of the tunnel access assessment relative to ice condition, location and quantity, CDRMS will select the appropriate removal methods and equipment to clear the ice, if present, to provide for safe access to the areas of the work. Ice removal equipment and methods will be selected based on the extent of the ice to be removed and safety of the method application underground. Safety considerations will include the amount of vibration, the mobility of the equipment, and the influence the method may have on the underground breathing atmosphere. Methods that may be applied are mechanical brakeage of ice with jack hammers or jack-leg rotary hammer drills. Elevating the temperature at ice obstructions may be implemented with heaters suitable for underground usage. Techniques for removal of the larger ice fragments that interfere with access will be examined. AR will procure the equipment from funds in escrow and provide support from outside the mine for the CDRMS contractor removing ice underground.

3.3 Blaine Tunnel Survey

Once ice removal (if necessary) is completed to provide access to the study area, qualified personnel selected by and under the direction of CDRMS will enter the tunnel to conduct a three dimensional laser survey of the tunnel. The limits of safe entry will be determined by CDRMS personnel. The study area will extend as far beyond the limits of safe access as the equipment will permit via line of sight without personnel entry beyond the safe limit. The survey equipment will consist of a three-dimensional robotic laser scanner station that provides an omni-directional laser distance scan from a given setup station. With conventional survey benchmark support, the scan information from several setup stations will be assembled into a geo-referenced three dimensional survey of the tunnel. In addition to the laser survey, the depth of water currently impounded behind the existing cofferdam will be measured at a sufficient number of points located by survey (either laser or conventional tape along centerline and offset measurements) to define the approximate volume of impounded water to the limits of safe access in the tunnel, and the associated elevation of the tunnel floor below the impounded water..

This work will provide an accurate survey of the tunnel, which will be used as a reference baseline to assess any changes within the tunnel, including significant movement of rock blocks within the tunnel, and will also provide a baseline for engineering controls as part of this and follow-on studies.

3.4 Blaine Base Flow Test

3.4.1 Initial Water Quality Testing of Impounded Water

As early as feasible, but prior to other work (prior to entry of the mine beyond the cofferdam), at least two (2) water quality samples of the impounded water behind the cofferdam will be collected. While these samples are not known to be representative of incoming Blaine Mine drainage, they provide an assessment of the ponded water quality and will allow a comparison to samples collected behind the cofferdam in 2011. Samples will be collected, preserved and analyzed in accordance with the current Rico Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP) and applicable Standard Operating Procedures (SOP). Samples will be analyzed for the parameters listed and by the methods shown in Table 1 .

3.4.2 Construction of Temporary Cofferdam

A temporary cofferdam will be constructed behind the existing cofferdam to provide for as complete an interception of Blaine Mine inflow as practical given the conditions present in the mine (Figures 2 and 3A). The purpose of this temporary cofferdam is to allow the base flow test described later to measure as much of the full volume of inflow as practical via pumping of the impounded water to accurately calculate or measure via flow totalizer the amount of inflow. The temporary cofferdam will provide head for pumps described later that will pump impounded inflows for flow measurement. By constructing the cofferdam in the location shown, the interception of flow can be visually verified and short-circuiting of flow past the pumps (e.g., via seepage through the blockage above the existing cofferdam) which could lead to an inaccurate flow measurement will be minimized.

The pumping location selected is up-gradient of the Humboldt Drift collapse, at a location that is intended to encounter water that is believed currently to be migrating into the collapse area and eventually to the Morris-Cook Incline. The temporary dam will be constructed to accumulate as much of the incoming flow from the Blaine Tunnel upgradient of the dam as practical and create a sump for pumping. The temporary dam planned is to be constructed with sand bags enclosed in a flexible plastic liner to aid in curtailing leakage through the sand bags. If necessary, provision will be made to seal leaks between the plastic-lined sand bags and the tunnel floor and walls with bentonite or other natural or synthetic materials that can be placed in flowing water. The location of the sand bag dam (Temporary Cofferdam) is depicted on Figure 3A. A staff gauge and water head pressure transducer will be positioned in the existing sump or another appropriate location to measure pond level behind the dam.

3.4.3 Basis of Pump Selection

The required pumping capacities are based on several pieces of information. An initial pumping flow test was attempted by CDRMS and EPA in the fall of 2011. The test was not fully executed; only an approximately 2-hour long pumping period was implemented due to technical problems. However, a very rough estimate of incoming water flow was made from the apparent approximately steady state of the water level behind the existing cofferdam in the Blaine Tunnel. The pumping rate was approximately 100 gallons per minute (gpm) and due to the limited fluctuation of the water level, it was inferred that the inflow was at least 100 gpm. Additionally, an estimate of the Blaine discharge flow rate was reported by Anaconda personnel in the 1980s at approximately 350 to 400 gpm (note that it is uncertain if some portion of this estimated flow was and still is diverted to lower workings via the No. 3 Shaft prior to reaching the Humboldt Drift and subsequently the Morris-Cook Incline). The primary pumping equipment for the flow measurement test is planned to handle from 100 to about 350 gpm. A reserve pump and hose will be available to supplement the pumping rate up to approximately 400 gpm if necessary.

The pumping equipment for use in the flow measurement test in the Blaine Tunnel has been selected based on several factors. The first consideration is the feasibility of the pumping network in wet underground conditions. The use of internal combustion engine driven pumps is prohibitive, since the engine exhaust would create a hazardous atmosphere in the mine workings without extensive mine ventilation systems. Electric motor driven pumps would require complex insulation and grounding of conductor cable and generators in water ponded areas and overall wet mine conditions. Pneumatic diaphragm pumps were selected for use underground. Pneumatic diaphragm pumps do not exhaust carbon monoxide gases and do not require electrical power to operate. These pumps are also available for a range of flow rates. Freezing of pumps can also be controlled if necessary with introduction of heated air or anti-freezing gas (tanner's gas) into the compressed air supply lines. The pump network will involve up to three

(3) each, 3-inch double diaphragm pumps for a total capacity of up to about 350 gpm. A reserve pump will be on-site for supplemental capacity.

3.4.4 Flow Test Setup

The Blaine flow measurement will be accomplished by a network of equipment that will be used both underground and on the surface near the Blaine Tunnel portal. Refer to Figure 4 for a schematic cross-sectional view of the planned operation. As previously mentioned, up to three (3) individual pumps will be used that are 3-inch pneumatic double diaphragm type, set at the selected pumping location underground. The pumps can be placed at the existing cofferdam or the preferred location immediately upgradient of the Humboldt Drift blockage. The pumps will be connected to a manifold and the consolidated flow will enter a single discharge hose. The pumps will be provided compressed air by way of air hose from a compressor (180 cfm minimum) situated outside the mine. All hose, fittings and couplings shall be compatible with pumping and air supply demands and compliant with regulatory safety requirements. Pumping rates can be controlled by the number of pumps operating and flow rate of the air supply.. The compressor will be engine-driven and precautions taken to avoid exhaust entry into the portal. The discharge flow will be monitored by a totalizing meter and an instantaneous flow meter outside the portal; an instantaneous flow meter will also be provided underground at the point of pumping. Both flowmeters will have a capacity of up to 450 gpm. If pump flow rates are substantially less such that the accuracy of the flowmeters is impacted, smaller flowmeters will be acquired, The discharge line will also be fitted with a valve controlled sampling port. Discharge flow will be routed into a surge tank (approximately 20,000 gallons capacity) near the 517 Shaft (formerly referred to as the Argentine Shaft). The Blaine mine water will be allowed to collect in the surge tank and will then be pumped using a centrifugal pump through a 6 inch diameter discharge hose to the 517 Shaft Access Tunnel. The hose will be connected to a pipe that extends down the 517 Shaft 40 to 60 feet. The discharge water will be pumped into the 517 Shaft at a controlled rate and the discharge hose positioned in a manner to avoid water erosional damage to the shaft timber lining near the top of the shaft. The total length of the pump and piping network is approximately 700 feet.

The underground operation of the pumps, pipelines and discharge pipelines will be monitored by certified underground crews contracted by CDRMS and live video feed to the surface at the Blaine Tunnel portal. Radio communication will be maintained with the underground crews and surface support at all times. Routine calls to all team members will be made by the surface safety coordinator and documented. Also, a roving live video camera attached to the helmet of an underground crew member will be used to monitor ongoing underground condition and activities.

AR will assist CDRMS with outside-of-mine (i.e., surface) support. Surface crew personnel will be assigned to assist mine entry crews as portal attendants. This duty will be in compliance with the Blaine Mine Entry and Safety Plan prepared by CDRMS. Emergency response plans will be prepared that coordinate surface and underground rescue and response. CDRMS is providing notification beacons for use by their staff and contractors underground; AR contractors will provide supplementary communication and live video equipment for deployment underground with live, continuous audio/video feed to the surface.

3.4.5 Flow Test Data Collection

The flow test methodology is designed to provide a measurement of free flowing Blaine drainage during the early part of the spring snow melt period while working around the difficult access and underground conditions. The test will provide data to solve the reservoir routing equation:

$$Q_{inflow} - Q_{outflow} = dS/dt$$

Where:

Q_{inflow} = Interior Blaine Tunnel discharge (flow into temporary cofferdam)

$Q_{outflow}$ = Pump outflow

dS/dt = Change in storage behind temporary cofferdam per unit of time (test to be conducted in a manner to reduce this term as close as possible to zero, and three dimensional survey data above and below water surface to be collected to characterize the stage-storage behind the cofferdam as closely as possible)

The interior Blaine discharge value (Q_{inflow}) is the objective of the test and is unknown. Because the existing cofferdam (and the proposed temporary cofferdam) will impound water beyond the limits of safe access, the inflow cannot be measured directly with any degree of accuracy via conventional flow measurement techniques (e.g., installation of a temporary flume). As a result, flow measurement will be based on the above “reservoir routing” methodology. The pump outflow will be measured via both instantaneous flow measurement and a flow totalizer.

A transducer with a coupled electronic data collector will measure the head in the impounded water behind the cofferdam. The initial three dimensional laser survey of the tunnel, together with depth measurements of the pooled water at surveyed locations, will provide data to develop an approximate stage-storage curve behind the existing and/or temporary new cofferdam. This curve will be used to assess changes in cofferdam pool storage with changes in head as a basis to compute the dS/dt term in the reservoir routing equation. However, it is believed that the laser and pond depth surveys will not be able to collect sufficient data to fully characterize the impounded water storage pool due to limits of safe access and line of sight limitations.

The change in storage behind the pool will be kept as limited as possible, and the pump flow test will be run long enough to minimize errors in the dS/dt term. Also, potential storage upstream of the limits of the survey from drawdown will be assessed for it’s potential impacts on the test and the test will be extended as necessary to reach a steady state in drawdown storage, if any. Personnel operating the pumps will have access to transducer level data as well as video observational capability and will adjust pump operating levels to maintain a target pool level and minimize pool level fluctuations around that pool level as much as possible so that the pump outflow nearly matches the Blaine Tunnel inflow. The pumping test will be conducted long enough to allow several fluctuations in storage around the target pool level so that the error in dS/dt averages as close to zero as practical. Pumps will be operated long enough to pump at least five (5) estimated storage volumes of the temporary cofferdam, or longer if other factors, such as drawdown storage indicate a longer test may be necessary. Pool level measurements will be acquired through the full recovery period of the main cofferdam.

The following information, at a minimum, will be recorded in conjunction with the base flow test:

- Continuous time and instantaneous pumping discharge rate from the surface flow meter.
- Continuous totalizer meter values or at intervals not to exceed 15 minutes during the test.
- Continuous pressure transducer readings from the cofferdam pool level sensor.
- Readings from the cofferdam staff gauge at intervals not to exceed 15 minutes.
- Time of any adjustments to the pumping rates as well as detailed notes of any pump malfunctions or shutdowns and durations, and increased monitoring as directed by AR on-site staff to capture its effect on pumping rate.
- Continuous visual monitoring of the temporary cofferdam for leakage and estimates at not more than 15 minute intervals of any minor seepage escaping the pumps past the cofferdam.
- General conditions within the tunnel from the live video feed at intervals not to exceed 15 minutes, with any changes described in detail.

3.4.6 Water Quality and Bench Scale Ion Exchange Testing Sample Collection

A secondary objective of the Blaine Base Flow Test is to obtain representative samples of Blaine inflows for preliminary loading comparison to the St. Louis Tunnel discharge, as well as a representative sample for preliminary ion exchange (IX) bench-scale testing.

As soon as feasible prior to the start of the flow test two water quality samples will also be collected of the St. Louis Tunnel discharge. The objective of these samples will be to collect water quality data prior to significant disturbance caused by the work at the Blaine Tunnel and discharge of flow test effluent in the 517 shaft that could impact results at the St. Louis Tunnel. Coupled with existing flow measurement at the St. Louis Tunnel, this will provide a loading for comparison to the Blaine Base Flow Test. Samples will be timed to correlate to the approximate diurnal low and high flows as determined by the existing St. Louis Parshall flume.

The flow sampling port described earlier and shown on Figure 4 just prior to the frac tank will be utilized to collect representative flow from the Blaine Tunnel unless conditions allow samples to be collected directly from an undisturbed flow stream within the Blaine Tunnel. The samples will be collected after the equivalent of at least five (5) estimated temporary cofferdam storage volumes have been pumped via the test. Samples for both baseline water quality and IX bench-scale testing will be collected.

Water quality samples will be collected, preserved and analyzed per the Rico SAP, QAPP and applicable SOPs as described previously and further detailed here. Sampling of the pumped water will be accomplished during the flow measurement test. A sampling port with valve will be placed into the discharge pipe line following the totalizer meter. Grab samples will be collected at select periods during the pumping activity. Lab supplied sample bottles with preservatives will be used to collect sample water for analyses. Standard operating procedures currently followed under the Rico SAP will be utilized including clean hands/dirty hands protocols. Water samples will be collected following flushing or purging of the discharge pipeline and after five (5) volumes have been pumped from behind the temporary cofferdam consistent with mine storage purging prior to sample collection. Field parameters will be measured at the time of sample collection. Field measurement data for pH, temperature, conductivity, dissolved oxygen and ORP (redox potential) will be collected. For quality control purposes, one duplicate sample and one field blank will be included with the water samples being submitted to the laboratory for analysis.

Samples for baseline water quality will be analyzed for the parameters and using the procedures presented in Table 1. Samples for bench scale ion exchange (IX) testing will be tested in accordance with a separate work plan currently in development.

4.0 Data Reduction and Evaluation

Data collected will be reduced and evaluated and results will be summarized in a Technical Memorandum (TM) to be submitted to EPA not later than 30 days after the conclusion of the investigations. Observational notes, photos, video and other information, including a qualitative assessment of the air curtain icing reduction performance from the Blaine Tunnel Access Assessment will be collected and summarized for inclusion in the TM. Records of ice removal, including equipment and techniques used, if necessary, will be summarized and included as well.

Water quality data from the existing and temporary cofferdam, Blaine Tunnel flow and St. Louis discharge samples will be reduced and QA/QC checked in accordance with the Rico SAP, QAPP, and SOPs and the results will be summarized. Transducer and flow meter data (both instantaneous and totalized) will be reduced via the methodology described previously to provide an estimate of the Blaine Tunnel flow. A single point averaged flow rate will be computed unless data allow for a time-varying rate to be computed. A preliminary loading comparison of the Blaine Tunnel flow relative to the St. Louis Tunnel discharge will be computed from the above data.

The results of the bench scale IX testing will be addressed in a separate Technical Memorandum as described in the IX testing work plan under development.

5.0 Schedule

The following schedule of activities is anticipated for completion of the Blaine Tunnel flow measurement work:

- Blaine Tunnel Access Coordination, Equipment Procurement, Safety and Control of Work, CDRMS Procurement - March 12 to March 26, 2012. This task is weather and avalanche hazard dependent.
- Blaine Tunnel Access Assessment - Week of March 26, 2012. This task is weather and avalanche hazard dependent.
- Ice Removal (if necessary as determined by access assessment) - April 30, 2012 to May 11, 2012.
- Blaine Tunnel Survey (depends on access and ice removal) - Week of May 14, 2012.
- Blaine Base Flow Measurement Test Mobilization - May 14 to May 18, 2012.
- Blaine Base Flow Measurement Test (2 weeks duration) - May 21, 2012 to June 1, 2012.

TABLES

Table 1
Analytical Parameters and Procedures Summary

Parameter	Minimum Detection Limit (MDL)	Method
Field Parameters		
pH (s.u.)	+/- 0.01 pH	EPA 150.2
Temperature	+/- 1°C	Standard Method 2550
Conductivity (µmhos/cm)	+/- 2% Full Scale	EPA 120.1
Dissolved Oxygen	+/- 2% Full Scale	SM 4500-OG
ORP (Redox Potential)	N/A	Ag/AgCl Probe
Non-Metals		
Alkalinity (mg/L as $CaCO_3$)	RL – 20 mg/L	EPA 310.1
Hardness (mg/L as $CaCO_3$)	RL – 0.5 mg/L	SM 2340 B
Total Dissolved Solids	RL – 5.0 mg/L	SM 2540C
Total Organic Carbon	0.5 mg/L	EPA 415.1
Total Suspended Solids	RL – 5.0 mg/L	SM 2540D
Cyanide	RL – 0.005 mg/L	EPA 335.4
Salinity	RL – 6 mg/L	SM 2510B (calculated)
Silica	0.1 mg/L	ASTM D859
Sulfate	RL – 1 mg/L	EPA 300.0
Sulfides	0.05 mg/L	EPA 376.2
Total and Dissolved Metals		
Aluminum	2 μg/L	EPA 200.8
Antimony	0.07 μg/L	EPA 200.8
Arsenic	0.09 μg/L	EPA 200.8
Barium	0.08 μg/L	EPA 200.8
Beryllium	0.02 μg/L	EPA 200.8
Cadmium	0.03 μg/L	EPA 200.8
Calcium	10 μg/L	EPA 200.8
Chromium	0.25 μg/L	EPA 200.8
Cobalt	0.05 0 μg/L	EPA 200.7
Copper	0.07 μg/L	EPA 200.8
Iron	4.67 μg/L	EPA 200.8
Lead	0.05 μg/L	EPA 200.8
Magnesium	2.5 μg/L	EPA 200.8

Manganese	0.17 µg/L	EPA 200.8
Mercury	0.049 µg/L	EPA 245.1
Nickel	0.07 µg/L	EPA 200.8
Potassium	10 µg/L	EPA 200.8
Selenium	0.22 µg/L	EPA 200.8
Silver	0.25 µg/L	EPA 200.8
Sodium	25 µg/L	EPA 200.8
Thallium	0.05 µg/L	EPA 200.8
Vanadium	0.05 µg/L	EPA 200.8
Zinc	2.5 µg/L	EPA 200.8
Rare Earth Elements		
Cerium	0.0054 µg/L	EPA 6020A
Dysprosium	0.013 µg/L	EPA 6020A
Erbium	0.011 µg/L	EPA 6020A
Europium	0.0090 µg/L	EPA 6020A
Gadolinium	0.011 µg/L	EPA 6020A
Holmium	0.0042 µg/L	EPA 6020A
Lanthanium	0.0062 µg/L	EPA 6020A
Lutetium	0.0048 µg/L	EPA 6020A
Neodymium	0.031 µg/L	EPA 6020A
Praseodymium	0.011 µg/L	EPA 6020A
Scandium	0.049 µg/L	EPA 6020A
Samarium	0.034 µg/L	EPA 6020A
Terbium	0.0065 µg/L	EPA 6020A
Thulium	0.0048 µg/L	EPA 6020A
Yttrium	0.012 µg/L	EPA 6020A
Ytterbium	0.0048 µg/L	EPA 6020A

FIGURES

IMAGERY COURTESY OF GOOGLE EARTH PRO

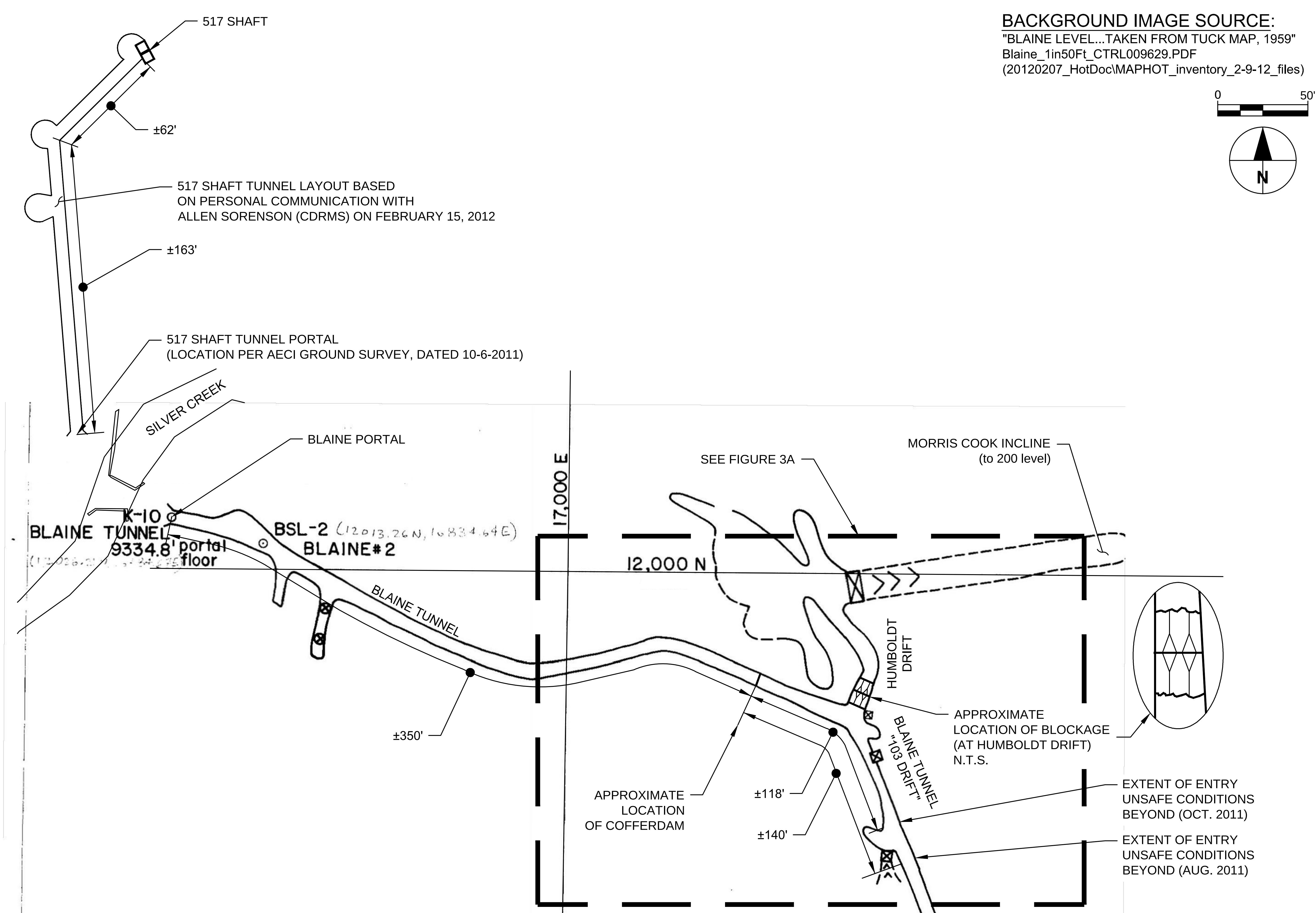
AECOM

60239806

RICO-ARGENTINE SITE-OU01

BLAINE BASE FLOW WORK PLAN

FIGURE 1 - RICO-ARGENTINE MINE SITE



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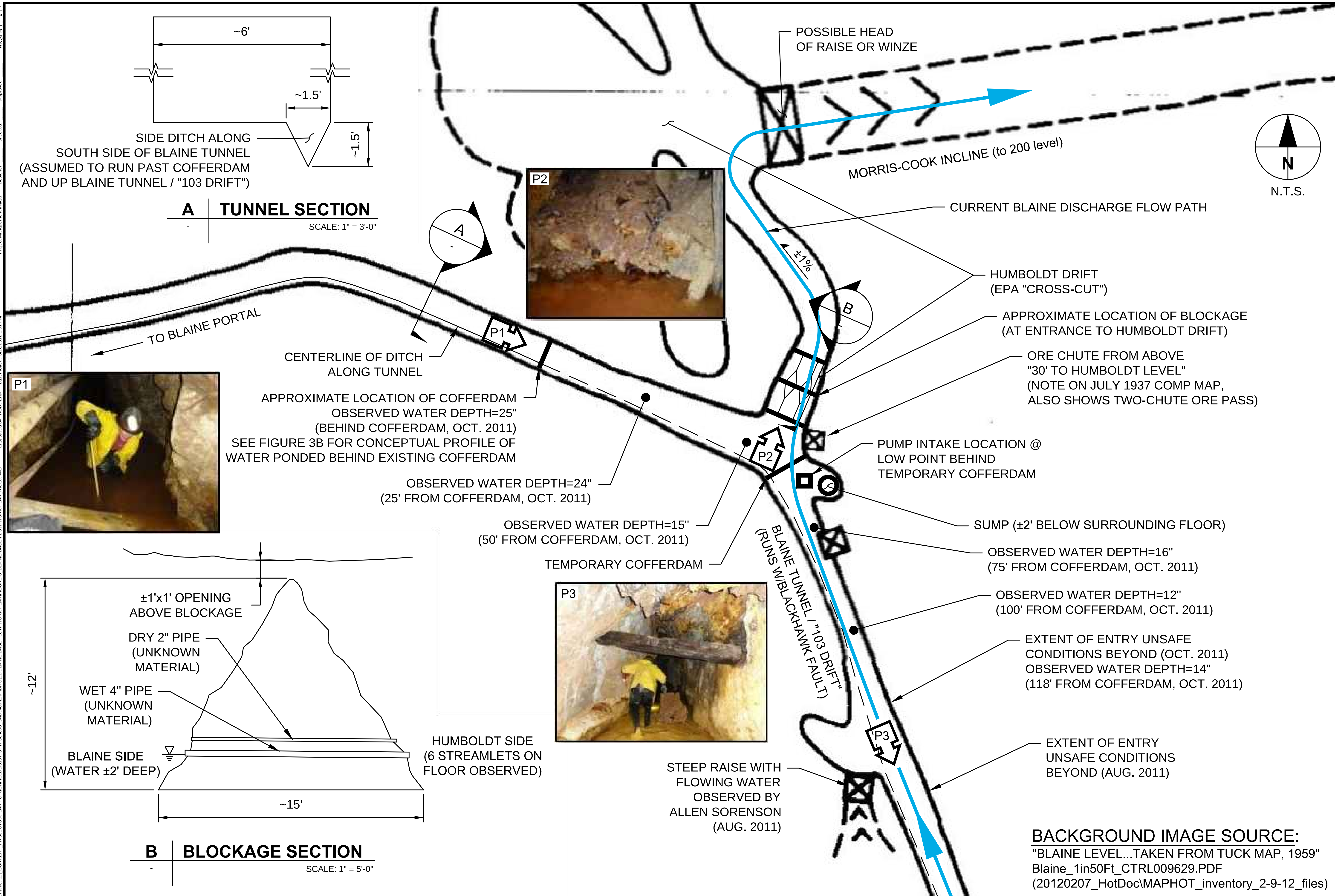
RICO-ARGENTINE SITE-OU01

BLAINE BASE FLOW WORK PLAN

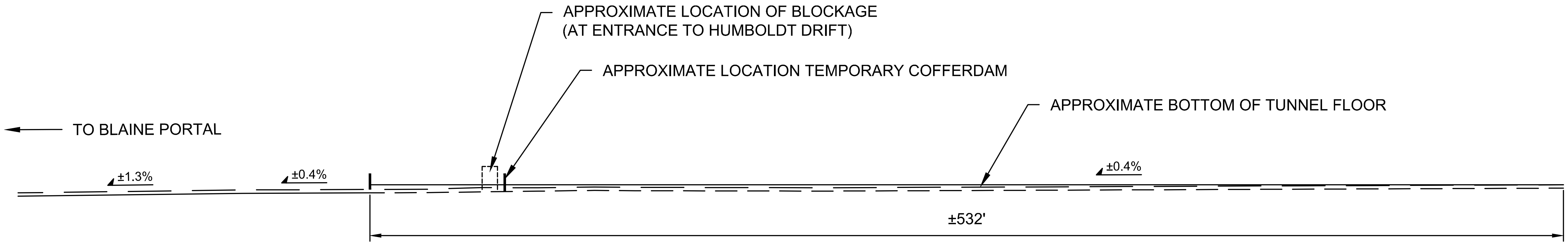
FIGURE 2 - BLAINE TUNNEL STUDY AREA



BACKGROUND IMAGE SOURCE:
"BLAINE LEVEL...TAKEN FROM TUCK MAP, 1959"
Blaine_1in50Ft_CTRL009629.PDF
(20120207_HotDoc\MAPHOT_inventory_2-9-12_files)

AECOM
60239806

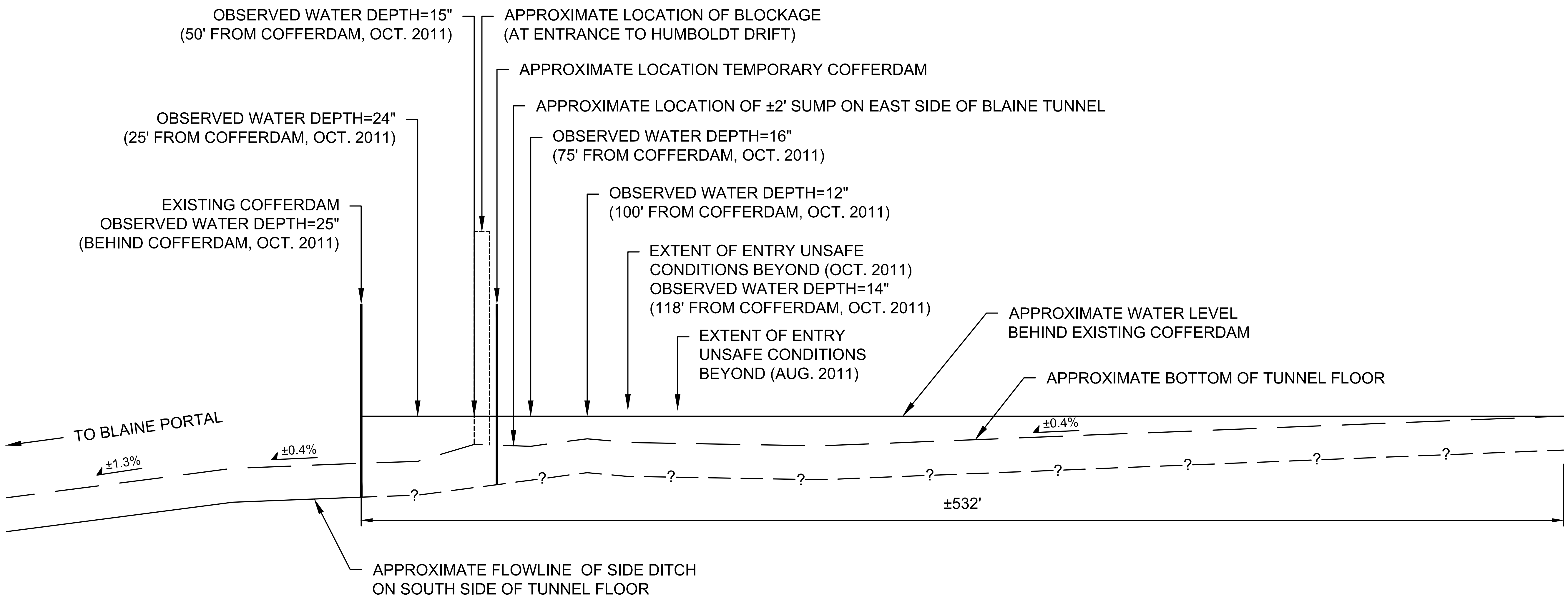
RICO-ARGENTINE SITE-OU01
BLAINE BASE FLOW WORK PLAN
FIGURE 3A - BLAINE TUNNEL PLAN



CONCEPTUAL TUNNEL PROFILE

SCALE: 1" = 50'

0 50'



CONCEPTUAL TUNNEL PROFILE (EXAGERRATED)

SCALE: 1" = 50' (H), 1" = 5' (V)

0 50' (H) 5' (V)

AECOM

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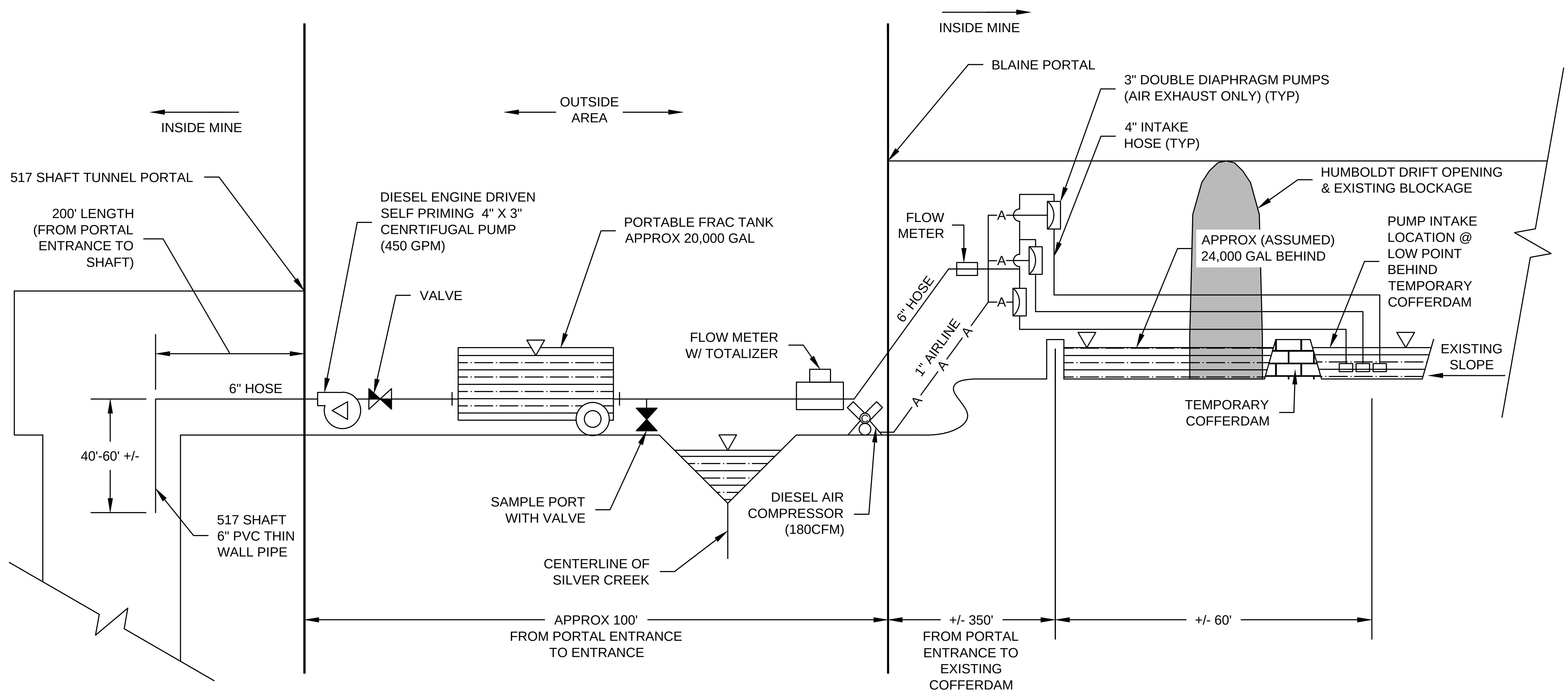
BLAINE BASE FLOW WORK PLAN

FIGURE 3B - BLAINE TUNNEL PROFILE



AECOM

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BLAINE BASE FLOW WORK PLAN

FIGURE 4 - SCHEMATIC SECTION VIEW